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AGRICULTURAL MEMORANDUM 520

DR M HOUGH

WEATHER AND BARLEY YIELD (3)

WEIGHT PER GRAIN

Data

109 trials had information on 1,000 kernel weight and meteorology, but only 53 trials had this data plus plant density and ear numbers.

Factors Affecting Grain Weight

1. Severe dehydration after ear emergence has long been known to reduce grain growth. Although this is not normally a problem in Europe, French workers in particular have related reduced grain growth to quite short periods of high temperature (>30°c) in the few weeks following ear emergence (Geslin and Vernet, 1952). This factor, known as "heat damage", was sometimes specifically mentioned in the E.B.C. trials for France, Spain and Portugal.

2. Ear size. If a large number of spikelets have been initiated it has sometimes been observed that the size of the grains is less than normal. Also, experiments which involve the removal of some of the grains of an ear have often shown that the remaining grains become heavier compared with an untreated ear. Another factor is spikelet competition. Remotely situated spikelets on an ear compete for nutrients eg if the spikelets at the base of an ear are initiated before the top spikelets then the growth of the latter is suppressed.

3. Plant density has been shown to affect the grain weight (Kirby, 1969), especially with the photoperiod below 13 hours.

4. Disease. It is well known that severe attacks of fungus diseases such as mildew and rust can cut yields. If these diseases attack the flag leaf or the ear itself then grain weight can be reduced (Davies, 1970).

The E.B.C. trials for Kenia barley were examined for responses to these factors.

Temperature

Heat damage, due to temperatures above 30°c after ear emergence, which caused a reduction in grain weight and shrivelling of the grain was mentioned in two trials and may have occurred in three others. The most sensitive time is about 20 days after ear emergence.

Ear Size

The correlation between 1,000 kernel weight and grain number per ear was -0.23 (53 sets of values). However, this was biassed by one extreme value. When this was not included the correlation fell to -0.11. It was not possible to consider the other factors mentioned in (2) above.

Plant Density

1,000 kernel weight was not highly correlated with density (correlation +0.34 (53 sets of values), +0.23 (52 sets of values)). Very little improvement was found when photoperiod was included.

Rainfall

The 109 trial results mentioned above were investigated for response to rain by using 3 classes for 1,000 corn weight:

$\leq$ 33 gm (below average), 35-36 gm (near average), $\geq$ 38 gm (above average).

Below average corn weights were frequently associated with wet weather from approximately 20 days before, to 5-10 days after ear emergence. Conversely, above average corn weights were associated with dry weather around ear emergence. The weather after ear emergence seemed to be less important although wet conditions following dry weather at ear emergence appeared particularly favourable for high corn weights. The division between "wet" and "dry" is somewhat arbitrary and would depend upon transpiration, but 20 mm of rain per 10 days seemed a useful dividing value.

Disease

It was noticed that trials with below average corn weights were often badly mildewed and that those above average were associated with slight mildew or none at all. Trials with near average corn weight often had a mixture of conditions eg moderate mildew infection and dry at ear emergence.

The table gives a summary of 1,000 corn weight data and shows the number of trials in each class.

1,000 corn weight	High ($\geq$38 gm)	Medium (35-36 gm)	Low ($\leq$33 gm)
Number of trials	24	15	17
No mildew data	8*	0	1
Agreement	12	11	13
Poor agreement	2	2	0
Difficult to classify	2	2	3

* Nearly all these agree based on the rainfall criterion alone.

Note: "agreement" for the "high" column means dry weather near ear emergence and a slight or nil attack of mildew or no mildew at all. For the "low" column it means hot weather after ear emergence or wet weather at ear emergence and/or a moderate to severe mildew infection. For the "medium" class it means neither very wet or very dry at ear emergence and with some mildew, especially in the drier seasons.

The classification was not successful in explaining all the data. This may be due in part to the method of mildew assessment since it is not known if the scale used was absolute or relative to the infection level at each trial.

Conclusions

1. A short period of high temperatures ($>30^{\circ}c$) about 20 days after ear emergence can reduce grain weights.

2. High corn weights were associated with dry weather around ear emergence (approximately 20 days before to 10 days after) together with a low level of mildew infection or none at all.

3. Wet weather around ear emergence or severe mildew was associated with low corn weights.

It is not known for certain which factor (rain or mildew) is important. Mildew requires wet leaves to infect its host plant (Agricultural Memorandum 355) so that the occurrence of mildew with wet weather is not surprising. However, the weather conditions need only be correct for a day or two for infection to occur.

It follows that a barley variety which is more resistant to mildew than Kenia should have higher corn weights. Union barley has a mildew resistance factor which does appear to benefit the corn weights in seasons when mildew infection is severe.

Any comments or criticisms should be sent direct to the author.

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Meteorological Office, Met O 8a
London Road
Bracknell
Berkshire

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